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A POPULATION STUDY OF A HIBERNAL
ROOSTING COLONY OF THE MONARCH
BUTTERFLY (*D. PLEXIPPUS*)
IN NORTHERN CALIFORNIA

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DURING THE SOUTHWARD MOVEMENT, or fall migration, of the monarch butterfly, temporary roosting sites are established at numerous locations. Such sites are of a transient nature in which the individuals remain for a short period of time, usually for a single night period. We refer to such sites as "transient migratory roosting sites".

On arriving at the over-wintering site, which from our previous studies (Urquhart, 1960) are located along the Gulf of Mexico from Florida to Mexico and parts of Central America and California, the migrants remain as free-flying individuals that are not associated with any definite roosting site, or as transients occupying a roosting site for an indefinite period of time. Some of these roosting sites appear to be of a more or less permanent nature, existing throughout the winter months, as is the case in the Monterey Peninsula, while others occur for a short period of time (Urquhart, 1960). So that we may discuss the variations and dynamics of the over-wintering populations, we refer to the colonies that establish roosting sites for a portion of the winter period as "transient hibernial roosting colonies" as distinct from those that are of a more permanent nature which we refer to as "hibernal roosting colonies". The distribution of some of these colonies have been previously located by Williams et al. (1942) and Urquhart (1960).

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Since little is known about the inter-relationship existing between these various over-wintering colonies and observed free-flying individuals, an investigation of a transient colony was undertaken which, together with studies of other colonies now in progress, will present a clearer picture of the over-wintering activities of this insect migrant.

The colony chosen for this investigation is located at Natural Bridges in Santa Cruz, California. The site occupies a grove of red gum eucalyptus trees. The roosting colony is located on the branches of the north central portion of the grove at distances of from six to forty feet above ground level. There are no other groves of trees along this part of the coast that could serve as suitable roosting sites.

The alar tag method (Urquhart, 1960) of individual identification was employed. Over seven thousand specimens were individually tagged during the period October 3 to December 19, 1964. When a tagged specimen had been recaptured and sent to our laboratory, a printed form was mailed to the person sending the specimen requesting the date, time and exact locality of the recapture. The locality was given as the street and house number in Santa Cruz where the specimen had been taken. The research associate who had tagged the specimen was informed of the recapture and a request made for the date and time of tagging. By this procedure, the pertinent information on the movement of a particular individual of a colony could be recorded and entered in our files, along with all correspondence concerning a particular flight record. Recaptured specimens which were not sent to us but simply reported as "having been seen" were considered invalid and were not entered in our research file; only actual tag returns were considered valid.

Referring to fig. 1, it will be noted that there were periods during which few or no recaptures were reported and other periods during which there were many. From observations of free-flying individuals within the area, together with these data, it may be concluded that during periods of suitable weather conditions members of the colony leave the roosting site in order to obtain food from nectar-bearing flowers. Such individuals may return to the same roosting site or they move on to a different locality where they may join a roosting colony or remain free-flying and roosting as solitary individuals during inclement or nocturnal periods.

Recaptures of individuals that had travelled in excess of one mile from the roosting site, but within the same hibernal period

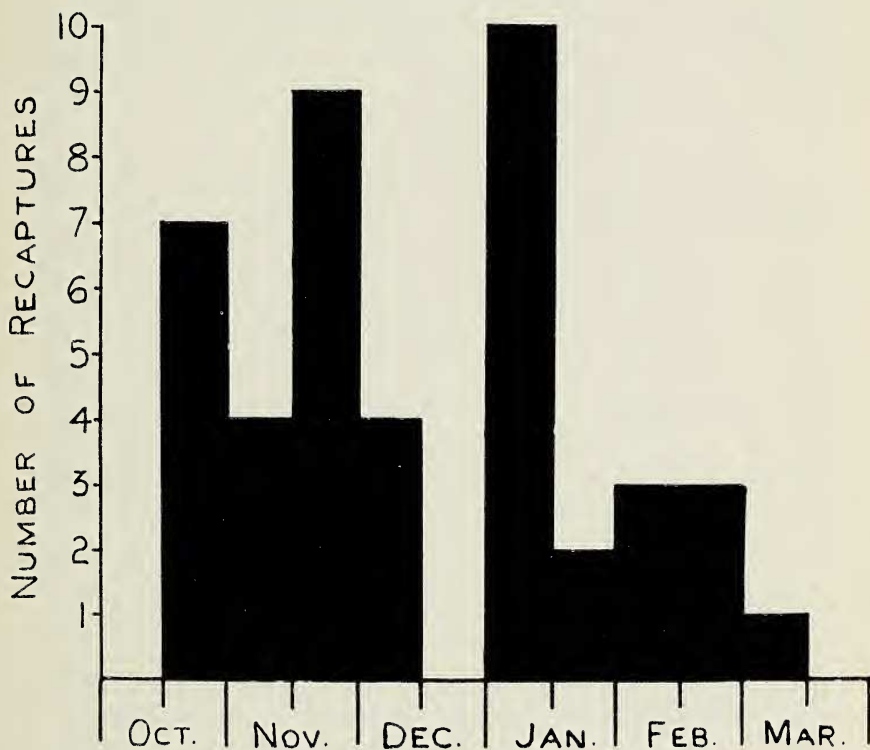


Fig. 1. Number of recaptures correlated with by-monthly time intervals indicating roosting and flight periods within the roosting site area.

and hence were not vernal migrants, show a similar pattern of movement with the exception that the flight period extends beyond the first half of February, thus occupying the entire overwintering period from the end of the autumnal movement to the beginning of the vernal movement.

The direction and distance travelled from the roosting site is indicated in the outline map of Santa Cruz, as shown in fig. 2. It will be noted that recaptures are most abundant to the north-east, between 10° and 60° with a tendency to a more easterly direction, between 60° and 80° for longer distances. This indicates a close relationship between individuals in the other roosting sites within the area and perhaps with those in the Monterey Peninsula and further south.

In addition to these data, observations on the Natural Bridges population indicate a complete withdrawal from the site during the latter half of December. This is correlated with the advance of a cold polar air mass. The physical effect of the cold temperature and frontal storms on members of the colony remaining at this exposed site was observed on December 19 at which time 1980 specimens were found beneath the roosting trees; these specimens, immobilized by the cold temperature and dislodged from the roosting trees by strong winds, were unable to return to the branches of the trees because the wings had become water-soaked (Urquhart, 1965). This was on the first day of a severe frontal storm that lasted intermittently for three weeks accompanied by heavy rain.

From the above data, we may conclude that migrating individuals arriving in northern California from the north and north-east establish transient hibernal colonies at various points where suitable roosting sites are available. Throughout the transient period, individuals leave the colony under suitable weather conditions, to obtain nourishment; such free-flying individuals may or may not return to the original site. Motion away from the site is to the east and south-east — the proximity to the ocean precluding any recorded movement to the west. Since the roosting site is located at the south-westerly portion of the city of Santa Cruz, few returns would be expected from the north-west. That not a single record was made to the north-west, however, would indicate little or no movement in this direction. A complete exodus from the original transient site takes place during the latter half of December and is, presumably, associated with polar air mass advancement. Thus, mem-

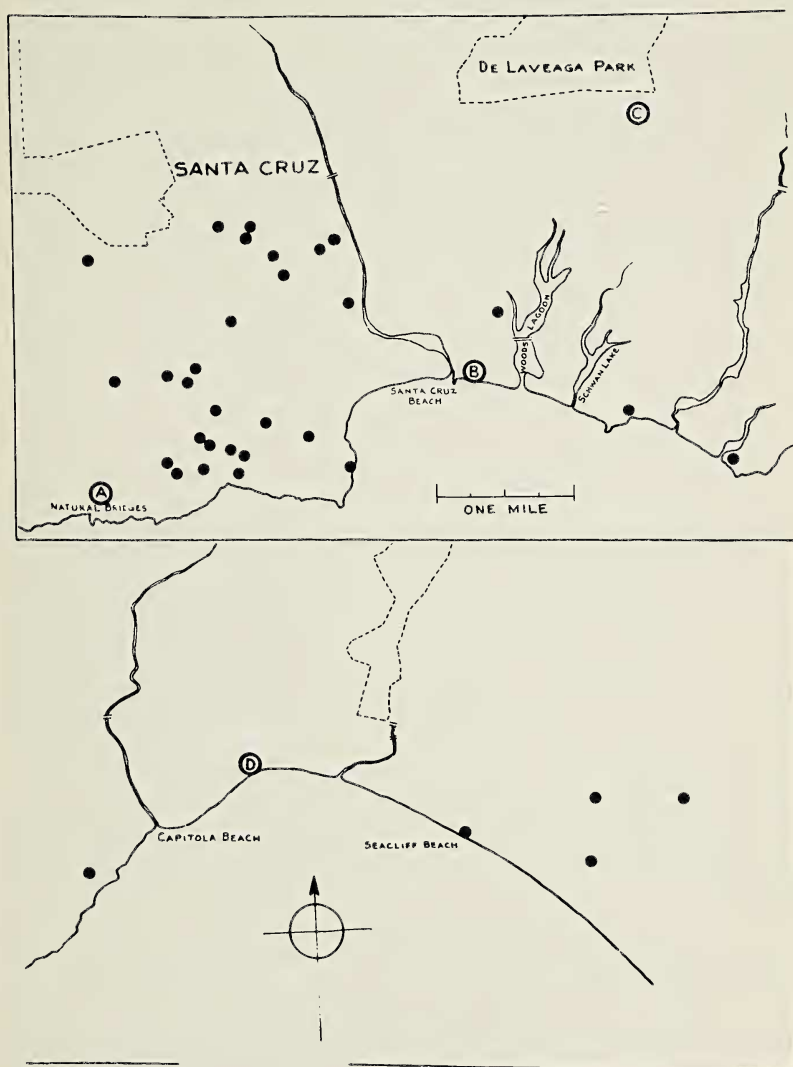


Fig. 2. Map of Santa Cruz, showing location of transient colonies A, B, C, D and recapture records (●).

bers of transient colonies move inland to other more protected sites or southward to other sites or as free-flying individuals.

Migrants from the east and north-east of California enter at various points extending as far south as Los Angeles (Urquhart, 1965). Transient colonies are thus established from Los Angeles, and perhaps as far south as San Diego, to Stinson Beach in northern California. The number of such transient colonies is not known but we assume that many more than now recorded will be located in the interior, particularly in the northern parts of the San Joaquin Valley, in the valleys of the Coastal Range as well as the better known colonies along the coast.

From the data here presented it is concluded that the over-wintering monarch butterflies in California represent a single genotrophic dissociated population. As such, they are active feeders and, for the most part, free-flying; they are not sedentary or in complete diapause. Individuals observed free-flying or as roosting colonies, are transient and as such may establish transient roosting sites during periods of inclement weather or hibernal colonies in which some members are present throughout the winter months, but the numbers of such seemingly permanent colonies vary as movement takes place from this site to another or as individuals remain free-flying. Static colonies, such as those in the Monterey Peninsula, are due to prolonged periods of inclement weather together with the suitability of the roosting site both topographically and the availability of suitable roosting trees (Williams et al, 1942). Such hibernal sites are, in so far as the entire over-wintering population is concerned, the exception rather than the rule. We believe that similar over-wintering activities as here described will be found with respect to colonies in parts of Florida, the Gulf Coast and Mexico.

ACKNOWLEDGMENT

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